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BIOENVIRONMENTAL ENGINEERING

Respiratory Protection

QUALIFICATION TRAINING PACKAGE

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STS Line Item 4.14.5: Select RP equipment

TRAINER GUIDANCE

Proficiency Code:	2b
PC Definition:	Can do most parts of the task. Needs help only on hardest parts. Can determine step by step procedures for doing the task.
Prerequisites:	None
Training References:	• AFI 48-137, *Respiratory Protection Program*, 15 July 2014 • 29 CFR 1910.134(d), *Respiratory Protection*
Additional Supporting References:	• 29 CFR 1910.10XX series (substance specific) • NIOSH Pub No. 2005-100, *NIOSH Respirator Selection Process 2004* • ANSI Z88.2-1992, *Respiratory Protection*
CDC Reference:	4B051
Training Support Material:	• Training scenario • AFI 48-137, *Respiratory Protection Program*, 15 July 2014 • 29 CFR 1910.10XX (if applicable) • NIOSH Certified Equipment List • AF Form 2773
Specific Techniques:	Conduct training and evaluation using a scenario or an actual industrial worksite.
Criterion Objective:	Given a chemical scenario, calculator, references, and a blank AF Form 2773, select the appropriate respirator successfully completing all checklist items with limited trainer assistance on only the hardest parts.

Notes:

AFI 48-137 para 2.12.2.1 states respirators will be selected IAW 29 CFR 1910.134 (d) and the NIOSH Certified Equipment List, and the rationale for selection will be documented by process in the workplace-specific written plan.

The respirator must be appropriate for the contaminant's physical form and chemical properties and the conditions under which it will be used. A NIOSH-approved respirator is then selected for the “situation” after the physical characteristics and functional capabilities and limitations, and the assigned protection factor have been considered.

See Notes section for formulas.

TASK STEPS

1. Identify the contaminant(s) of concern.
2. Determine if there is an OSHA substance-specific standard or other Air Force-approved guidance for the contaminant(s).[1]
3. Assemble relevant information for each contaminant of concern and classify the contaminant(s) *(Complete Parts I and II of AF Form 2773.)*[2]
4. Calculate a hazard ratio (HR) for each contaminant (see Notes for formula).[3]
5. Identify any special considerations *(Part III of AF Form 2773.)*[4]
6. Select the respiratory protective device appropriate for the contaminant's physical form and chemical properties and the conditions under which it will be used using criterion in 29 CFR 1910.134 (d), the AF Form 2773, and professional judgment.
7. Complete Part IV of the AF Form 2773 (or OEHMIS) and file.
8. Utilize OEHMIS (DOEHRS or equivalent), as applicable.

LOCAL REQUIREMENTS:

NOTES:

1. OSHA substance-specific standards and or AF approved guidance such as USAFSAM technical guides or AF Medical Support Agency policy letters sometimes specify threat control measures or occupational and environmental exposure limits (OEEL). If any such guidance exists for a contaminant of concern, follow those guidelines and requirements.

2. The following information is needed to classify contaminant(s) of concern and complete selection process and Parts I and II of AF Form 2773:
   - Contaminant name
   - Physical form
   - OEEL
   - Lower explosive limit
   - IDLH
   - Carcinogen
   - Sensitizer
   - Possible skin absorption
   - Concentration
   - Hazard ratio
   - Target organs and organ systems
   - Warning properties

3. Select respirators with an assigned protection factor (APF) greater than the value of the hazard ratio, as listed in AFI 48-137, Attachment 2. Divide the time-weighted average (TWA) exposure concentration for the contaminant by the OEEL. If the exposure limit is an 8 hour limit the TWA used must be on 8 hour average. If the exposure limit is based on 10 hours, use a 10 hour TWA.

4. The following information is needed to complete selection process and Part III of AF Form 2773:
   - If two or more contaminants affect same target organ the compliance factor must be calculated.

- Isocyanate containing compounds
- Oxygen content & distance to hazard
- Work rate
- Temperature extremes – AFI 48-137, Attach 5 & 6
- Length of time respirator worn
- Communication devices – AFI Std 48-137, Attach 4
- Vision
- Other personal protective equipment worn
- Respirator worn in confined space

Formulas:

$$HR = \frac{TWA}{OEEL}$$

Where:
TWA = time weight average
OEEL = occupational exposure limit

- If the contaminant has a ceiling limit, divide the maximum exposure concentration for the contaminant by the ceiling limit
- If the contaminant has a short term exposure limit (STEL), divide the maximum 15 min TWA exposure concentration for the contaminant by the STEL

TRAINEE REVIEW QUESTIONS

STS Line Item 4.14.5: Select RP equipment

1. What is the first step in the respirator selection process?
2. Describe the information relevant to classifying a contaminant of concern.
3. Where does rationale for selecting a specific respirator get documented?

PERFORMANCE CHECKLIST

STS Line Item 4.14.5: Select RP equipment

Proficiency Code:	2b
PC Definition:	Can do most parts of the task. Needs help only on hardest parts. Can determine step by step procedures for doing the task.

DID THE TRAINEE…	YES	NO
1. Identify the contaminant(s) of concern?		
2. Determine if there is an OSHA substance specific standard or other Air Force-approved guidance for the contaminant(s) *(Complete Parts I and II of AF Form 2773)*?		
3. Assemble relevant information for each contaminant of concern and classify the contaminant?		
4. Calculate a hazard ratio for each contaminant?		
5. Identify any special considerations *(Part III of AF Form 2773)*?		
6. Select the appropriate respiratory protective device?		
7. Complete Part IV of the AF Form 2773 (or OHMIS equivalent)?		
8. Utilize OEHMIS (DOEHRS or equivalent), as applicable?		
Did the trainee successfully complete the task?		

TRAINEE NAME (PRINT) TRAINER NAME (PRINT)

ANSWERS

1. What is the first step in the respirator selection process?

   A: Identify the contaminant(s) of concern.

   (Source: Step 1 of this QTP)

2. Describe the information relevant to classifying a contaminant of concern.

   A:

   - Contaminant name
   - Physical form
   - OEEL
   - LEL
   - IDLH
   - Carcinogen
   - Sensitizer
   - Possible skin absorption
   - Concentration
   - Hazard ratio
   - Target organs and organ systems
   - Warning properties

   (Source: Note 2 of this QTP)

3. Where does rationale for selecting a specific respirator get documented?

   A: In the workplace-specific written plan and on the AF Form 2773, Respirator Selection Worksheet, and the Shop Detail page in DOEHRS-IH

(Source: AFOSH Std 48-137, *Respiratory Protection Program*, Aug 2013, para 2.12)

STS Line Item 4.14.7: Perform qualitative fit tests

TRAINER GUIDANCE

Proficiency Code:	3c
PC Definition:	Can do all parts of the task. Needs only a spot check of completed work. Can identify why and when the task must be done and why each step is needed.
Prerequisites:	None
Training References:	• 29 CFR 1910.134, *Respiratory Protection*, Appendix A
Additional Supporting References:	None
CDC Reference:	4B051
Training Support Material:	• Enclosure Hood • Nebulizers • Threshold Screening Test solution • Filtering Face pieces or Masks • Bitrex (or isoamyl acetate (IAA-Banana Oil) or Irritant smoke) • Stop watch/timer
Specific Techniques:	Conduct hands-on training and evaluation of trainee's ability to perform qualitative fit tests.
Criterion Objective:	Given equipment, respirators, fit-testing supplies, and references, perform qualitative fit testing successfully completing all checklist items with NO trainer assistance.
Notes: This QTP covers how to perform QLFT using Bitrex solution since that is the most commonly used when performing QLFT. For guidance on other options, see 29 CFR 1910.134, *Respiratory Protection*, Appendix A.	

TASK STEPS

1. Prepare the Threshold Screening Test[1]
2. Perform the Threshold Screening Test[2]
3. Document the taste threshold number[3]
4. Instruct the individual on procedures to follow during the QLFT[4]
5. Perform the qualitative fit test[5]
6. Determine pass or fail[6]

LOCAL REQUIREMENTS:

NOTES:

1. Prepare the Threshold Screening Test
   - The Bitrex taste threshold screening, performed without wearing a respirator, is intended to determine whether the individual being tested can detect the taste of Bitrex.
   - During threshold screening (as well as during fit testing), subjects shall wear an enclosure hood.
   - Throughout the threshold screening test, the test subject shall breathe through his or her slightly open mouth with tongue extended. The subject is instructed to report when he/she detects a bitter taste.

2. Perform the Threshold Screening Test
   - Using a nebulizer, the test conductor shall spray the threshold screening test solution into the enclosure.
   - To produce the aerosol, the nebulizer bulb is firmly squeezed so that the bulb collapses completely, and is then released and allowed to fully expand.
   - An initial ten squeezes are repeated rapidly and then the test subject is asked whether the Bitrex can be tasted. If the test subject reports tasting the bitter taste during the ten squeezes, the screening test is completed. The taste threshold is noted as ten regardless of the number of squeezes actually completed.
   - If the first response is negative, ten more squeezes are repeated rapidly and the test subject is again asked whether the Bitrex is tasted. If the test subject reports tasting the bitter taste during the second ten squeezes, the screening test is completed. The taste threshold is noted as twenty regardless of the number of squeezes actually completed.
   - If the second response is negative, ten more squeezes are repeated rapidly and the test subject is again asked whether the Bitrex is tasted. If the test subject reports tasting the bitter taste during the third set of ten squeezes, the screening test is completed. The taste threshold is noted as thirty regardless of the number of squeezes actually completed.
   - If the Bitrex is not tasted after 30 squeezes, the test subject is unable to taste Bitrex and may not perform the Bitrex fit test.

3. Document the taste threshold number
   - The test conductor will take note of the number of squeezes required to solicit a taste response

4. Instruct the individual on procedures to follow during the QLFT – during the test, the individual will be required to perform the following exercises:
   - ***Normal Breathing***: In a normal standing position, without talking, the subject shall breathe normally.
   - ***Deep Breathing***: In a normal standing position, the subject shall breathe slowly and deeply, taking caution not to hyperventilate.

- ***Head Side-to-Side***: Standing in place, the subject shall slowly turn their head from side to side between the extreme positions on each side. The head shall be held at each extreme momentarily so the subject can inhale at each side.
- ***Moving Head Up and Down***: Standing in place, the subject shall slowly move their head up and down. The subject shall be instructed to inhale in the up position (i.e., when looking at the ceiling).
- ***Talking***: The subject shall talk out loud slowly and loud enough as so as to be heard clearly by the test conductor. Use the Rainbow Passage (at the end of the notes section), or have them count backwards from 100, or recite a memorized poem or song.
- Bending Over: The test subject shall bend at the waist as if they were to touch their toes. (Jogging in place shall be substituted if bending is not feasible.)
- Normal Breathing: In a normal standing position, without talking, the subject shall breathe normally.

5. Perform the qualitative fit test
   - The test subject shall don the enclosure while wearing the respirator selected.
   - As before, the test subject shall breathe through his or her slightly open mouth with tongue extended, and be instructed to report if he/she tastes the bitter taste of Bitrex.
   - The nebulizer is inserted into the hole in the front of the enclosure and an initial concentration of the fit test solution is sprayed into the enclosure using the same number of squeezes (either 10, 20 or 30 squeezes) based on the number of squeezes required to elicit a taste response as noted during the screening test.
   - Every 30 seconds the aerosol concentration shall be replenished using one half the number of squeezes used initially (e.g., 5, 10 or 15).
   - Every 60 seconds the test subject will be instructed to start a new exercise as described in Step 4.

6. Determine pass or fail
   - The test subject shall indicate to the test conductor if at any time during the fit test the taste of Bitrex is detected. If the test subject does not report tasting the Bitrex, the test is passed.
   - If the taste of Bitrex is detected, the fit is deemed unsatisfactory and the test is failed. A different respirator shall be tried and the entire test procedure is repeated (taste threshold screening and fit testing).

Rainbow Passage

When the sunlight strikes raindrops in the air, they act like a prism and form a rainbow. The rainbow is a division of white light into many beautiful colors. These take the shape of a long round arch, with its path high above, and its two ends apparently beyond the horizon. There is, according to legend, a boiling pot of gold at one end. People look, but no one ever finds it. When a man looks for something beyond reach, his friends say he is looking for the pot of gold at the end of the rainbow.

TRAINEE REVIEW QUESTIONS

STS Line Item 4.14.7: Perform qualitative fit tests

1. How much time before the test should the subject not eat, drink (except plain water), smoke, or chew gum?
2. During the Taste Threshold Screening, what happens if the Bitrex is not tasted after 30 squeezes?
3. If it is not feasible for the test subject to bend over during the exercises for the QLFT, what could be substituted?

PERFORMANCE CHECKLIST

STS Line Item 4.14.7: Perform qualitative fit tests

Proficiency Code:	3c
PC Definition:	Can do all parts of the task. Needs only a spot check of completed work. Can identify why and when the task must be done and why each step is needed.

DID THE TRAINEE…	YES	NO
1. Prepare the Threshold Screening Test?		
2. Perform the Threshold Screening Test?		
3. Document the taste threshold number?		
4. Instruct the individual on procedures to follow during the QLFT?		
5. Perform the qualitative fit test?		
6. Determine pass or fail?		
Did the trainee successfully complete the task?		

TRAINEE NAME (PRINT)

TRAINER NAME (PRINT)

ANSWERS

1. How much time before the test should the subject not eat, drink (except plain water), smoke, or chew gum?

   A: The test subject may not eat, drink (except plain water), smoke, or chew gum for 15 minutes before the test.

   (Source: 29 CFR 1910.134, *Respiratory Protection*, Appendix A)

2. During the Taste Threshold Screening, what happens if the Bitrex is not tasted after 30 squeezes?

   A: The test subject is unable to taste Bitrex and may not perform the Bitrex fit test

   (Source: 29 CFR 1910.134, *Respiratory Protection*, Appendix A)

3. If it is not feasible for the test subject to bend over during the exercises for the QLFT, what could be substituted?

   A: Jogging in place shall be substituted if bending is not feasible.

   (Source: 29 CFR 1910.134, *Respiratory Protection*, Appendix A)

STS Line Item 4.14.8: Perform quantitative fit tests

TRAINER GUIDANCE

Proficiency Code:	3c
PC Definition:	Can do all parts of the task. Needs only a spot check of completed work. Can identify why and when the task must be done and why each step is needed.
Prerequisites:	None
Training References:	• 29 CFR 1910.134, *Respiratory Protection*, Appendix A • TSI FitPlus Fit Test Software User's Manual
Additional Supporting References:	AFOSH Std 48-137, *Respiratory Protection Program*, Chapter 7
CDC Reference:	4B051
Training Support Material:	• Various respirators/gas mask • PortaCount or M41 PATS • Twin tube assembly • Wick assembly • 99.5% reagent grade isopropyl alcohol • Sample tube extender • Gas mask fit adapter • Fit test filter adapters • Particle generator • Spectacle Inserts (as necessary) • Fit test area
Specific Techniques:	Conduct hands-on training and evaluation of trainee's ability to fit test both an industrial respirator and military unique gas mask.
Criterion Objective:	Given equipment, respirators, fit-testing supplies, and references, perform quantitative fit testing successfully completing all checklist items with NO trainer assistance.

Notes:

Per AFOSH Std 48-137, QNFT will be accomplished in accordance with Air Force T.O. 14P4-15-11, Operator and Unit Maintenance Manual for Protective Assessment Test System (PATS), M41 or other approved policy. Ensure all test masks are clean before conducting a test. A fit test shall not be conducted if there is any hair growth between the skin and the facepiece sealing surface, such as stubble beard growth, beard, mustache or sideburns which cross the respirator sealing surface. Any type of apparel which interferes with a satisfactory fit shall be altered or removed. If a test subject exhibits difficulty breathing during the tests, they shall be referred to a physician or other licensed health care professional to determine whether the test subject can wear a respirator while performing their duties. If the test subject finds the fit of the respirator unacceptable, the test subject shall be given the opportunity to select a different respirator and be re-tested.

TASK STEPS

1. Set-up PortaCount per the manufacturer's instructions.
2. Demonstrate donning procedures to the individual.[1]
3. Inform the individual they are to select respirators that provide the most acceptable fit.[2]
4. Instruct the individual to hold each chosen facepiece up to the face and eliminate those that obviously do not give an acceptable fit.[3]
5. Note the more acceptable respirators in case the one selected proves unacceptable.
6. Have the individual don and wear for 5 minutes the respirator that provides the most acceptable fit.[4]
7. Assess comfort of the selected mask.[5]
8. Place fit testing adapters on the mask.[6]
9. Instruct the individual to seat the mask.[7]
10. Instruct the individual to perform a user seal check.[8]
11. Attach the clear tube on the tube assembly to the fit test adapter.
12. Brief the individual on fit-test procedures, exercises to be performed, and responsibilities during the test.[9]
13. Instruct the individual to don any safety equipment that will be worn during actual respirator use which could interfere with respirator fit.
14. Press the *COUNT* key.[10]
15. Press the *FIT TEST* key.
16. Press the *START/STOP TEST* key.
17. Determine pass or fail.[11]
18. Document results in DOEHRS.[12]

LOCAL REQUIREMENTS:

NOTES:

1. Prior to the selection process, the test subject shall be shown the procedures listed below.
   - how to put on a respirator
   - how it should be positioned on the face
   - how to set strap tension
   - how to determine an acceptable fit

2. Offer a sufficient number of respirator models and sizes so that the respirator is acceptable to, and correctly fits, the user.

3. Assess adequacy of respirator based on the following criteria:
   - chin placement
   - positioning and fit across nose bridge
   - strap tension
   - adequate size to span from nose to chin
   - tendency to slip
   - self-observation in mirror

4. If the individual is not familiar with using a particular respirator, direct them to don the mask several times and to adjust the straps each time to become adept at setting proper tension on the straps

5. Assess comfort base on the following:
   - position of the mask on the nose
   - room for eye protection
   - room to talk
   - position of mask on face and cheeks

6. For gas mask, attach a red adapter to the drinking tube.

7. The mask is seated on the face by moving the head from side-to-side and up and down slowly while taking in a few slow deep breaths. Another facepiece shall be selected and retested if the test subject fails the user seal check tests.

8. Either the negative and positive pressure seal checks described in 29 CFR 1910.134, Appendix B-1, or those recommended by the respirator manufacturer which provide equivalent protection to the procedures in Appendix B-1.

9. The following exercises are administered during a *respirator* fit test. Each exercise is performed for one minute except for the GRIMACE; it's done for 15 seconds.
   - ***Normal Breathing***: In a normal standing position, without talking, the subject shall breathe normally.
   - ***Deep Breathing***: In a normal standing position, the subject shall breathe slowly and deeply, taking caution not to hyperventilate.
   - ***Head Side-to-Side***: Standing in place, the subject shall slowly turn their head from side to side between the extreme positions on each side. The head shall be held at each extreme momentarily so the subject can inhale at each side.
   - ***Moving Head Up and Down***: Standing in place, the subject shall slowly move their head up and down. The subject shall be instructed to inhale in the up position (i.e., when looking at the ceiling).
   - ***Talking***: The subject shall talk out loud slowly and loud enough as so as to be heard clearly by the test conductor. Use the Rainbow Passage here, or have them count backwards from 100, or recite a memorized poem or song.
   - ***Grimace***: The test subject shall grimace by smiling or frowning.
   - ***Bending Over:*** The test subject shall bend at the waist as if they were to touch their toes. (Jogging in place shall be substituted if bending is not feasible.)
   - ***Normal Breathing:*** In a normal standing position, without talking, the subject shall breathe normally.

   The following exercises are administered during a gas mask fit test:
   - ***Normal Breathing***: (head motionless): In a normal standing position, without talking, the subject breathes normally.
   - ***Deep Breathing***: (in through nose, out through mouth): In a normal standing position, the subject breathes slowly and deeply, taking care not to hyper-ventilate.
   - ***Head Side-to-Side***: (over shoulder, 1 second intervals): Standing in place, the subject slowly turns their head from side-to-side between extreme positions on each side. The subject holds their head at each extreme momentarily to allow them to inhale at each side.
   - ***Moving Head Up and Down***: Standing in place, the subject slowly moves their head up and down. Instruct the subject to inhale in the up position (i.e., when looking toward the ceiling).
   - ***Rotating Chin***: Standing in place, the subject moves their jaw in a circular pattern, holding the mouth slightly open to simulate speaking (like chewing gum).

10. Particle count must be below 3 (particles/cm3) before starting the test.

11. The PortaCount will automatically stop and calculate the overall fit factor for the entire set of exercises. The overall fit factor is what counts. The Pass or Fail message will indicate whether or not the test was successful.

12. In accordance with AFI48-137, results are documented in DOEHRS-IH and three (3) hard copies are provided to the individual, one for placement in mask carrier, one to be provided to the UDM, and one to be maintained by the member.

TRAINEE REVIEW QUESTIONS

STS Line Item 4.14.8: Perform quantitative fit tests

1. When demonstrating respirator donning procedures, what should be shown?
2. List the criteria used to evaluate the adequacy of a respirator.
3. How does a test subject seat a respirator on their face prior to conducting the negative and positive pressure checks?
4. How long should the subject wear a respirator before fit testing begins?

PERFORMANCE CHECKLIST

STS Line Item 4.14.8: Perform quantitative fit tests

Proficiency Code:	3c
PC Definition:	Can do all parts of the task. Needs only a spot check of completed work. Can identify why and when the task must be done and why each step is needed.

DID THE TRAINEE…	YES	NO
1. Set-up PortaCount per the manufacturer's instructions?		
2. Demonstrate donning procedures to the individual?		
3. Inform the individual they are to select respirators that provide the most acceptable fit?		
4. Instruct the individual to hold each chosen facepiece up to the face and eliminate those that obviously do not give an acceptable fit?		
5. Note the more acceptable respirators in case the one selected proves unacceptable?		
6. Have the individual don and wear for 5 minutes the respirator that provides the most acceptable fit?		
7. Assess comfort of the selected respirator?		
8. Place fit testing adapters on the mask		
9. Instruct the individual to seat the mask?		
10. Instruct the individual to perform a user seal check?		
11. Attach the clear tube on the tube assembly to the fit test adapter?		
12. Brief the individual on fit-test procedures, exercises to be performed, and responsibilities during the test?		
13. Instruct the individual to don any safety equipment that will be worn during actual respirator use which could interfere with respirator fit?		
14. Press the *COUNT* key?		
15. Press the *FIT TEST* key?		
16. Press the *START/STOP TEST* key?		
17. Determine pass or fail?		

18. Document results in DOEHRS?		
Did the trainee successfully complete the task?		

TRAINEE NAME (PRINT)

TRAINER NAME (PRINT)

ANSWERS

1. When demonstrating respirator donning procedures, what should be shown?

   A: The test subject shall be shown:
   - how to put on a respirator,
   - how it should be positioned on the face,
   - how to set strap tension, and
   - how to determine an acceptable fit.

(Source: 29 CFR 1910.134, *Respiratory Protection*, Appendix A)

2. List the criteria used to evaluate the adequacy of a respirator.

A:
- Chin placement
- Positioning and fit across nose bridge
- Strap tension
- Adequate size to span from nose to chin
- Tendency to slip
- Self-observation in mirror

(Source: 29 CFR 1910.134, *Respiratory Protection*, Appendix A)

3. How does a test subject seat a respirator on their face prior to conducting the negative and positive pressure checks?

   A: The subject shall be told to seat the mask on the face by moving the head from side-to-side and up and down slowly while taking in a few slow deep breaths.

   (Source: 29 CFR 1910.134, *Respiratory Protection*, Appendix A)

4. How long should the subject wear a respirator before fit testing begins?

   A: Five minutes.

   (Source: 29 CFR 1910.134, *Respiratory Protection*, Appendix A)